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## **Bargaining Frictions, Labor Income Taxation and Economic Performance**

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**Abstract:**

A matching model with labor/leisure choice and bargaining frictions is used to explain (i) differences in GDP per hour and GDP per capita, (ii) differences in employment and hours worked (per capita and per worker), (iii) differences in the proportion of part-time work across countries. The model predicts that the higher the level of rigidity in wages and hours the lower are GDP per capita, employment, part-time work and hours worked, but the higher is GDP per hour. In addition, it predicts that a country with a high level of rigidity in wages and hours and a high level of income taxation has higher GDP per hour and lower GDP per capita, employment and part-time work than a country with less rigidity and a lower level of taxation. This is due mostly to a lower level of employment. In contrast, a country with low levels of rigidity in hours and in wage setting but with a higher level of income taxation has a lower GDP per capita and a higher GDP per hour than the economy with low rigidity and low taxation. In this configuration, the level of employment is similar in both economies but the share of part-time work is larger. The model accounts well qualitatively for the facts, and a plausible calibration accounts well qualitatively for the differences between the US, French and Dutch economies.

**Keywords:** Models of search and matching, bargaining frictions, economic performance, labor market institutions, part-time jobs, labor market rigidities

**JEL Classification:** E24, J22, J30, J41, J50, J64

# 1 Introduction

It is arguable that the bulk of cross-country variations in economic performance can be linked to differences in labor market organization. In this paper, we focus on two labor market features, rigidity in contracting and labor income taxation, and show that they are indeed of first order importance in explaining differences in economic performance amongst European countries as well as between European countries and the US. The focus is on three countries that personify the key differences one can identify, France, the Netherlands and the US. The indicators of economic performance we focus on are GDP per capita, GDP per hour, hours worked per capita, employment and the proportion of part-time jobs. We frame our analysis in a matching model in which risk-averse workers and risk-neutral firms vary in productivity and face idiosyncratic shocks to productivity. Workers value leisure, and workers and firms bargain over wages and over the length of the work day. We show that four elements of our model are necessary to explain the observed cross-country differences: bargaining over the length of the workday, heterogeneity, frictions and income taxes.

This paper fits in a recent literature documenting and trying to explain differences across countries in economic performance. Rogerson (2006) stresses that a combination of technological change and government intervention is the best candidate to account for the long term changes in hours worked across countries. Prescott (2003) highlights the importance of labor income taxation to explain differences in employment and hours worked between Europe (seen as mainly France) and the US; Ljungqvist and Sargent (2007) argue that, in a model similar to Prescott's, adding unemployment insurance diminishes the bite of labor income taxation. In an empirical paper, Nickell (2004) claims that while taxes do explain part of the differences, they are far from making up the entire story. Pissarides (2007) argues that productivity growth plays a big role in the evolution of hours, and is the main reason for the healthy state of labor markets in Europe in the 1960's. In addition, he shows that while taxes play a role in explaining differences in hours, it is mostly a minor one. To contrast to this literature, this paper shows that, while labor income taxation is not enough to account for cross-country differences in economic performance, including the proportion of part-time jobs, adding bargaining rigidities on both wages and hours goes a long way in explaining these differences both qualitatively and quantitatively.

Finally, a number of papers are related to ours with regards to modeling assumptions.

Gertler and Trigari (2007) introduce staggered bargaining in a matching model with the hope of resolving the unemployment volatility puzzle (as described in Pissarides (2008)). Blazquez and Jansen (2008) propose a matching model with heterogeneous agents on both sides to assess whether the market equilibrium ends up being efficient (it doesn't). Ortega (2003) uses a model with ex-post heterogeneous firms to show that the existence of a legal limit on hour choices can enhance efficiency with respect to *laissez-faire*. Nagypál (2005) uses potentially negative idiosyncratic shocks to the value of a job to workers in a search model and endogenous search effort to show that such a model can successfully replicate job-to-job transition data.

The paper is organized as follows. In Section 2, data on economic performance and labor market institutions are briefly presented for France, the Netherlands, and the US. The model is described in Section 3. The economy is parameterized, and the effects of changes in the probability of recontracting and in the rate of taxation are presented and analyzed. Finally, the relative importance of the rigidity in wages and the rigidity in hours choices to the results are presented. A final section concludes.

## 2 Economic Performance and Labor Market Institutions

Two indicators of economic performance are used to classify countries: GDP per capita as a measure of wealth and GDP per hour as a measure of productivity. Labor market performance of the countries is given by employment (and unemployment) together with hours worked (per capita and per worker). When focusing solely on the indicators of economic performance, the traditional European vs Anglo-saxon opposition applies. Taking the US as the reference for Anglo-saxon countries, it dominates Europe in GDP per capita, but most European countries fare at least as well as the US in terms of GDP per hour, the exception being the Nordic countries and Switzerland. Focusing on labor market performance indicators, differences within Europe are encountered. The big four European countries (to which we can add Belgium) have low employment level, correspondingly high unemployment levels, and relatively few hours worked.<sup>1</sup> These countries drive the European average so that, on average, Europe has a lower rate of employment and a higher unemployment rate than the US even

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<sup>1</sup>See Nickell (2003) and Faggio and Nickell (2007) for detailed discussions on labor market performance in Europe and the US.

though a majority of European countries have similar employment and unemployment rates than those observed in the US. To simplify the discussion, we focus our data discussion on three countries, France as a representative of the sluggish big European countries, the US as the representative of Anglo-saxon countries, and the Netherlands, which we take to represent the high employment, low hours, countries of Europe. Nordic countries are not considered as their social institutions (and economic and labor market performance) are historically very different from those of other OECD countries, and we ignore Switzerland, which is close to the anglo-saxon type (ignoring growth). The Netherlands is also the most extreme country in terms of our final element of differentiation of labor market performance, part-time work. It is the country where there is the highest proportion of jobs that are part-time (defined as jobs of less than 30 weekly hours), either when looking at both genders or focusing on women or men only. On this count, most European countries have numbers similar to those of anglo-saxon countries, with the US being the country where part-time is least prevalent. Hu and Tjiddens (2003) further suggest that a big portion of part-time jobs in the Netherlands consist of retention part-time.<sup>2</sup>

The data on economic and labor market performance can be summarized in the following observations.<sup>3</sup> First, GDP per capita is higher in the US than it is in Europe. Second, GDP per hour is higher in France and the Netherlands than it is in the US. Third, employment is much higher in the US and in the Netherlands than it is in France. Fourth, hours per capita is much higher in the US than in Europe, but France and the Netherlands exhibit a similar level, with Dutch people working a bit more than the French per capita but a little less per worker. Fifth, a large proportion of jobs in the Netherlands is part-time, which is not the case in either of the other countries. This is true when all genders are taken into account but is also present when looking only at men, albeit at lesser absolute levels. A summary of the data on the economic performances of France, the Netherlands and the US can be found in Table 1.

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<sup>2</sup>Retention part-time consists of part-time agreements, usually for jobs requiring a certain level of skills, that are used to retain workers in a job while waiting for better economic conditions for the firm.

<sup>3</sup>We proceed to give a more detailed account of the data on hand in the Appendix.

Table 1: Economic Performance

	France	Netherlands	US
GDP per capita	77	82	100
GDP per hour	103	106	100
Hours per capita	74	83	100
Employment rate (%)	62	73	72
Part time (% , whole)	13.7	33.9	13.4
Part time (% , men 25-54)	4.1	5.9	2.7

Notes: All data from the OECD data base for 2002, except Hours per capita, Groeningen Growth and Development Center for 2003. GDP per capita, GDP per hour and Hours per capita are expressed relative to the US.

To explain these differences in performance, we emphasize the importance of flexibility of the labor market, represented by flexibility in contracting over wages and hours, as well as labor income taxation. Regarding these labor market institutions, the US is undoubtedly the country with the most flexible labor market. The share of workers covered by wage bargaining is very low and the level of coordination between unions and employers is low. There is no legal maximum number of hours worked and the level of income taxation is low. The Netherlands have a more flexible labor market than France. The share of workers covered by wage bargaining is high in both countries, and a legal maximum number of hours worked is imposed by law. However, while in France there is a low level of coordination between the unions and the employers, there is a high level of coordination in the Netherlands. As argued by Nickell and van Ours (2000), this high level of coordination in the Netherlands leads to a higher degree of flexibility of the labor market. Furthermore, wage bargaining takes place at smaller intervals in the Netherlands than in France. In addition, agreements between the unions, the employers and the government in the Netherlands in the early 1980's have led to more flexibility in the choice of hours worked as the union gave up their resistance to part-time jobs (see Nickell and van Ours (2000) for a discussion). Finally, labor income taxation in both France and the Netherlands is high. To summarize, the US and France represent two extremes in terms of labor market flexibility and in terms of labor income taxation. The Netherlands is an intermediate case with a relatively flexible labor market but with a high level of taxation (see the appendix for more details).

### 3 The Model

To show the importance of rigidities and taxation in explaining differences in economic and labor market performance, in which we introduce 4 important characteristics that are outlined next.

#### 3.1 The ingredients

Four ingredients are essential to our model. First, there is ex-ante heterogeneity in both worker and firm types, and they are affected by idiosyncratic shocks. These shocks can be positive or negative, and represent the changes in productivity that come about as life goes by, changes which are not modeled explicitly. A shock to a worker's productivity can result from health events, such as sickness or accident, family events, such as marriage, divorce or child birth, the passage of time leading to aging and loss or gain of human capital. Changes in a firm's productivity can come about through changes in demands, installation and implementation of new machines, arrival of a new boss, or internal reorganizations which may be conducive of better or worse employee performance. The shocks can in addition be viewed as representing uncertainty, given that types are known ex-ante in the model. Employment in the model can be viewed as a match between a firm and a worker. Because of ex-ante heterogeneity, matches may be of varying quality. This results in a situation in which high levels of employment can translate in more or less production per hour depending on the quality of sorting in the economy. In particular, an increase in the level of unemployment has two opposite effects on production. The fall in employment has a negative effect on production. The improvement in sorting due to the destruction of low quality matches has a positive one.

Second, it is assumed that firms and workers may bargain over both hourly wages and hours worked. Labor/leisure choice and bargaining over hours worked introduces the possibility to work part-time when a pair matches. Third, the bargaining process is subject to frictions: firms and workers engaged in a match cannot renegotiate every period, but they know the probability with which they will be allowed to bargain in the future. Hit by idiosyncratic shocks, firms and workers may want to readjust the number of hours they work and the corresponding hourly wage. This is not always possible, however, because of the bargaining frictions. These frictions thus create a distortion in both the choice to work or

not to work and in the selection of the length of the working day. Part-time in our model can be viewed as retention part-time: pairs that are close to negative period surplus but have high future prospects (due to potential shocks) use part-time in order to lock up matches while waiting for better days. As mentioned above, retention part-time is highly present in the Netherlands.

Fourth, differences in labor income taxation are introduced. Taxes distort the value of employment for workers. For similar levels of rigidities, an increase in the labor income tax induces some workers to switch from full-time to part-time employment, others to abandon their full-time jobs, and still others to quit their part-time jobs. These four ingredients together with the two-sided approach combine to deliver a rich depiction of the labor market. The two-sided view of the labor market is both necessary for the results and justified as an assumption, since the labor market is one that is inherently heterogeneous on two sides and in which both sides search for their better option. We now proceed to lay out explicitly our economy.

### 3.2 The model

Ours is a quantitative two-sided search model with ex-ante heterogeneity in both worker and firm types and idiosyncratic shocks, as proposed in Danthine (2005), extended to include labor/leisure choices and bargaining frictions. Time is discrete. The economy is inhabited by heterogeneous and infinitely-lived workers and firms. A worker's productivity level is labeled by  $z \in Z = \{z_1, \dots, z_N\}$ , while a firm's productivity is denoted by  $x \in X = \{x_1, \dots, x_M\}$ . A worker of type  $z_k$  evolves to type  $z_l$  with transition probability  $Z(l|k)$ . Similarly, a firm's productivity evolves from  $x_i$  to  $x_j$  following the transition probability  $X(j|i)$ . When searching for a worker, a firm holding a vacancy meets a worker of type  $z_k$  with probability  $\Omega_k$ . Similarly, an unemployed worker meets a firm of type  $x_i$  with probability  $\Phi_i$ . A newly matched pair  $ik$  bargains over the hourly wage  $w_{ik}$  and the number of per period hours  $h_{ik}$ . If the two find a mutually agreeable arrangement, they produce using production function  $F_{ik}(h_{ik})$ . In that case, define the indicator function  $I_{ik} = 1$ . Otherwise, they lose a productive period, have to search once more next period and  $I_{ik} = 0$ . A previously matched pair composed of types  $ik$ , with previous contract  $(w, h)$ , evolves to  $jl$  with probability  $X(j|i)Z(l|k)$ . With probability  $\pi$ , the pair can bargain over a new contract. If the two parties manage to agree on new terms,  $I_{jl} = 1$  and the new contract is  $(w_{jl}, h_{jl})$ . Otherwise they lose a period, start



searching again, and  $I_{jl} = 0$ . With probability  $(1 - \pi)$ , they are not allowed to recontract. In that case, either they agree to remain together, allowing one to define an indicator function  $J_{jl}(w, h) = 1$ . If either member (or both) find that searching grants a higher value, they separate and  $J_{jl}(w, h) = 0$ . Thus the coefficient  $\pi$  is a measure of the degree of contracting stickiness in the economy and can be calibrated to match the data. This type of Poisson adjustment process is widely used in the macroeconomic literature, often to model staggered price setting behavior, following Calvo (1983).

### 3.3 Firms

A firm can be in any of three situations at the beginning of a period: matched with a worker and allowed to bargain again; matched with a worker and not allowed to bargain, in which case the worker and the firm must choose whether to remain matched at the previously set conditions or to split; vacant and in negotiation with a worker. Let  $V_i$  be the value for a firm of type  $i$  of remaining vacant and  $P_{ik}$  the value of a new contract for a firm of type  $i$  matched with a worker of type  $k$ . Finally, let  $L_{ik}(w_{ik}, h_{ik})$  be the value for a firm of type  $i$  matched with a worker of type  $k$  of producing under a previous contract  $h_{ik}$ . Then,

$$P_{ik} = F_{ik}(h_{ik}) - w_{ik}h_{ik} + \beta \sum_j \sum_l X(j|i)Z(l|k) \left[ \pi \left( I_{jl}P_{jl} + (1 - I_{jl})V_j \right) + (1 - \pi) \left( J_{jl}(w_{ik}, h_{ik})L_{jl}(w_{ik}, h_{ik}) + (1 - J_{jl}(w_{ik}, h_{ik}))V_j \right) \right]. \quad (1)$$

Although complicated at first sight, this expression is straightforward.  $F_{ik}(h_{ik}) - w_{ik}h_{ik}$  is just the net profit of the firm over the period. The pair  $ik$  then evolves to  $jl$  with probability  $X(j|i)Z(l|k)$ ; with probability  $\pi$ , it can renegotiate and either decide to pursue their partnership ( $I_{jl} = 1$ ) or not. With probability  $(1 - \pi)$ , the pair cannot renegotiate, and must decide whether to remain in partnership at the old contract ( $J_{jl}(w_{ik}, h_{ik}) = 1$ ) or not. The value of remaining vacant is simply given by

$$V_i = \beta \sum_j \sum_l X(j|i)\Omega_l \left( I_{jl}P_{jl} + (1 - I_{jl})V_j \right), \quad (2)$$

where  $X(j|i)\Omega_l$  is the probability of evolving from type  $i$  to type  $j$  and to meet a worker of type  $l$ . Notice that a newly matched pair is always allowed to bargain. Finally,

$$L_{ik}(w, h) = F_{ik}(h) - wh + \beta \sum_j \sum_l X(j|i)Z(l|k) \left[ \pi \left( I_{jl}P_{jl} + (1 - I_{jl})V_j \right) + (1 - \pi) \left( J_{jl}(w, h)L_{jl}(w, h) + (1 - J_{jl}(w, h))V_j \right) \right]. \quad (3)$$

The continuation part of this expression is identical to that in (1). The first part is just the net period profits given current types and past hours and wages.

### 3.4 Workers

A worker can be in the same three situations, and the expressions for workers' value functions are very similar to those of the firm. Denote the value of being employed at newly negotiated terms by  $E$ , the value of being employed at formerly negotiated terms by  $T$ , and the value of being unemployed by  $U$ . The value for a type  $k$  worker of being employed by a type  $i$  firm is given by

$$E_{ik} = u((1 - \tau)w_{ik}h_{ik}, h_{ik}) + \beta \sum_j \sum_l X(j|i)Z(l|k) \left[ \pi \left( I_{jl}E_{jl} + (1 - I_{jl})U_l \right) + (1 - \pi) \left( J_{jl}(w_{ik}, h_{ik})T_{jl}(w_{ik}, h_{ik}) + (1 - J_{jl}(w_{ik}, h_{ik}))U_l \right) \right]. \quad (4)$$

It looks very much like equation (1), the difference being that workers have possibly non-linear utility  $u(\cdot)$  and may be taxed at rate  $\tau$ . The value of being unemployed is just

$$U_k = u(0, 0) + \beta \sum_j \sum_l Z(l|k)\Phi_j \left( I_{jl}E_{jl} + (1 - I_{jl})U_l \right). \quad (5)$$

Finally, being employed by a type  $i$  firm but at past hours  $h$  and wage  $w$  yields

$$T_{ik}(w, h) = u((1 - \tau)wh, h) + \beta \sum_j \sum_l X(j|i)Z(l|k) \left[ \pi \left( I_{jl}E_{jl} + (1 - I_{jl})U_l \right) + (1 - \pi) \left( J_{jl}(w, h)T_{jl}(w, h) + (1 - J_{jl}(w, h))U_l \right) \right]. \quad (6)$$

### 3.5 Nash Bargaining

We now define two indicator functions,  $I$  and  $J$ . The first follows from the Bargaining problem. A firm of type  $i$  and a worker of type  $k$  choose earnings  $e_{ik}$  and hours  $h_{ik}$ , with

$e_{ik} = w_{ik}h_{ik}$  to maximize the product of their surpluses under the constraint that both surpluses must be non-negative:

$$\max_{h,e} [P_{ik}(e, h) - V_i] \quad \times \quad [E_{ik}(e, h) - U_k], \quad (7)$$

*st.*

$$P_{ik}(e, h) \geq V_i \quad \text{and} \quad E_{ik}(e, h) \geq U_k. \quad (8)$$

If a solution to this problem exists, then  $I_{ik} = 1$ , otherwise  $I_{ik} = 0$ . In similar fashion,  $J_{ik}(e, h) = 1$  if, at the terms of the last negotiated contract  $(e, h)$ , both firm and worker have a positive surplus, so that  $L_{ik}(e, h) \geq V_i$  and  $T_{ik}(e, h) \geq U_k$ . Otherwise, if either or both prefer searching again,  $J_{ik}(e, h) = 0$ . With the existing distribution of workers and firms and with the newly defined indicator function, it is possible to update the distributions.

### 3.6 Updating the Distributions

Updating the probability of meeting a worker or a firm of a certain type involves counting. Let  $M_{ikop}^b$  be the measure of pairs of type  $ik$  who in the previous period were allowed to bargain and chose a contract  $(w_{op}, h_{op})$ .<sup>4</sup> Similarly, let  $M_{ikop}^n$  be the measure of pairs of type  $ik$  who did not bargain in the previous period, had a previously agreed upon contract  $(w_{op}, h_{op})$ , and remained together. Then  $\sum_o \sum_p (M_{ikop}^b + M_{ikop}^n)$  is the measure of  $ik$  pairs who were matched in the previous period. Of these worker-firm pairs, a proportion  $\pi$  are allowed to renegotiate. In addition, there is a measure  $\Phi_i \Omega_k N$  of  $ik$  pairs who meet in the market. If they can find a mutually agreeable contract  $(w_{ik}, h_{ik})$ , then they engage in production ( $I_{ik} = 1$ ). Any pair consisting of types  $i$  and  $k$  evolves to types  $j$  and  $l$  with probability  $X(j|i)Z(l|k)$ . Hence, at the beginning of the next period, the measure of  $jl$  pairs who were matched with contract  $(w_{ik}, h_{ik})$  is given by:

$$M_{jl ik}^{b'} = [(\sum_o \sum_p M_{ikop}^b + M_{ikop}^n)\pi + \Phi_i \Omega_k N] I_{ik} X(j|i) Z(l|k). \quad (9)$$

In somewhat similar fashion, multiplying the measure of pairs of type  $ik$  who had contract  $(w_{op}, h_{op})$  by  $(1 - \pi)$  yields the measure of  $ik$  firms who cannot renegotiate and have to decide whether or not to continue producing at the past contractual terms. If they decide it is worth to maintain their relationship,  $J_{ikop} = 1$ . The probability that they evolve to  $jl$  is given by

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<sup>4</sup>In fact, this implies they were of type  $op$  in the previous period.

$X(j|i)Z(l|k)$ . Summing over all possible  $ik$ 's leads to the measure of  $jl$  pairs who cannot rebargain and carry over choice  $h$  from this period to the next:

$$M_{jlop}^{n'} = \sum_i \sum_k [M_{ikop}^b + M_{ikop}^n](1 - \pi)J_{ikop}X(j|i)Z(l|k). \quad (10)$$

The probability of meeting a worker of type  $k$  is just the measure of unmatched workers of that type divided by the total number of unmatched workers. To obtain this, define  $A_{jl}$  as the measure of  $jl$  pairs who met in the previous period and did not find an agreeable contract, given that they were allowed to (re-)bargain. Similarly, define  $B_{jl}$  to be the measure of pairs  $jl$  who decided not to produce last period given that they could not renegotiate. These are given by

$$A_{jl} = \sum_i \sum_k \left[ \sum_o \sum_p (M_{ikop}^b + M_{ikop}^n)\pi + \Phi_i \Omega_k N \right] (1 - I_{ik})X(j|i)Z(l|k), \quad (11)$$

and

$$B_{jl} = \sum_i \sum_k \left[ \sum_o \sum_p (M_{ikop}^b + M_{ikop}^n(1 - \pi)(1 - J_{ikop})) \right] X(j|i)Z(l|k). \quad (12)$$

It should be clear that the measure of unmatched workers or firms is given by the double sum

$$N' = \sum_l \sum_j (A_{jl} + B_{jl}). \quad (13)$$

Summing  $A_{jl} + B_{jl}$ , for each firm type, across worker types and dividing by  $N'$  yields the distribution of vacancy types. The distribution of unemployed is obtained in similar fashion. Formally,

$$\Phi'_j = \frac{\sum_l (A_{jl} + B_{jl})}{N'}, \quad (14)$$

and

$$\Omega'_l = \frac{\sum_j (A_{jl} + B_{jl})}{N'}. \quad (15)$$

### 3.7 Stationary Equilibrium

A stationary equilibrium is a set of value functions  $E, P, U, V, L, T$ , distributional functions  $\Phi, \Omega, M^b, M^n, N$  and indicator functions  $I, J$  such that  $E, P, U, V, L, T$  satisfy equations (1)-(6),  $I, J$  are defined by (7), and the distributions are stationary.

## 4 Results

To evaluate the model, three steps are taken. First, functional forms are given and the parameters are chosen: we parameterize the economy to match features and estimation for the US economy. Second, the properties of the numerical equilibrium and their sensitivity to parameter changes are discussed. Third, changes in income taxation coupled with changes in the probability of recontracting are introduced. This allows us to use the model to explain the differences in economic performance of the United States, France, and the Netherlands documented above.

### 4.1 Parametrization

Functional forms for the production function, for individual preferences and for the idiosyncratic shocks must be specified. The production function is assumed to be a Cobb-Douglas with  $\alpha = 0.4$  and  $\mu = 0.9$ , which implies diminishing returns to hours worked:

$$F_{ik}(h) = h^\mu (x_i^\alpha z_k^{1-\alpha}). \quad (16)$$

The utility function is assumed to be

$$u(c, h) = \frac{c^{(1-\sigma)}}{1-\sigma} - a \frac{h^\nu}{\nu}. \quad (17)$$

Preference parameters, like the technology parameters, are set following existing literature standards. The parameter of risk aversion,  $\sigma$ , is set to be 0.4. The parameter that fixes the level of consumption-leisure elasticity is set to  $a = 3.5$  in the benchmark parametrization. Similarly,  $\nu$  is set to 1.3.<sup>5</sup>

The rate of time preference is set to  $\beta = 0.99$ . This implies that the length of the period in the model is approximatively half a year. The preference and technology parameters used in the benchmark model are summarized in Table 2. To ease computational strain, workers and firms have to choose one of four possible work days:  $h \in \{0.25, 0.5, 0.75, 1\}$ .

As underlined before, the idiosyncratic shocks can be positive or negative. We interpret them as representing a whole set of factors that affect productivity of workers and of firms. For instance a worker's productivity can be affected by an upcoming divorce, by learning or training, by sickness, while a firm's productivity is affected by changes in demand, by wear

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<sup>5</sup>The results are checked to be robust to variations in the parameters  $\alpha, \mu, \sigma, a$ , and  $\nu$ .

Table 2: Model Parameters

Parameter	Meaning	Value
$\beta$	discount factor	0.99
$\sigma$	risk aversion	0.4
$\nu$	labor/leisure parameter	1.3
$a$	aversion to work	3.5
$\alpha$	coefficient on firm type (production function)	0.4
$\mu$	coefficient on hours (production function)	0.9
$\rho^f$	persistence of shock to firms	.95
$\rho^w$	persistence of shock to workers	.95
$\epsilon^f$	sd shock to firm	.3
$\epsilon^w$	sd shock to workers	.3
$\pi$	recontracting probability	varies

and tear. In addition, these shocks can be viewed as representing uncertainty in an economy where types are known ex-ante. Given this, how should we set the shocks? A good indicator of individual productivity is the education level. People do not lose their education, however, although human capital depreciates. But, while their diploma stays fixed, circumstances of life change, and their productivity may evolve over time both positively or negatively. On the firm side, we could ideally, interpret a firm's type as its productivity. Unfortunately, data on firm productivity is hard to come by. There is some data available on job skill requirements, in terms of education, of posted vacancies. Here, it is assumed that the type of a firm corresponds to its job skill requirement. The idiosyncratic shocks to the firms are then calibrated so that the distribution of job skill requirements among *all firms* in the model corresponds to the distribution, *among vacancies*, in the 1985 PSID (as reported by Handel (2000)).

We thus calibrate the idiosyncratic shocks using Tauchen's method to approximate AR processes (4 parameters) through a Markov matrix. We restrict the process so that (i) the distribution of education levels in the model is roughly similar to that in the data, (ii) the movement between diplomas is not 'too' large (i.e. there is sufficient persistence), (iii) we obtain a similar employment rate in the model as in the data (71.3 vs 72), and (iv) we match data on vacancy requests. While the benchmark shocks are chosen in the way described above, we also perform extensive sensitivity analysis to understand the effects of variations in the parameters guiding the shocks on the results. The model distributions as well as those

for the US (BLS 2001 (workers) and PSID 1985 (firms)) can be found in Table 3.

Table 3: Distribution of Education Levels and Job Skill Requirements

Education	Worker		Firm	
	Model	US	Model	US
< HS	10%	10.1%	10%	13.2%
HS and some college	56%	59.6%	56%	56.3%
college	24%	20.0%	24%	23.4%
> college	10%	10.2%	10%	7.1%

Source: BLS 2001 (workers) and PSID 1985 (firms).

In the next section, the effects of changes in the probability of recontracting, as well as changes in labor taxation, are analyzed.

## 4.2 Contracts, Taxes and Labor Market Performance

The behavior of the model when the probability of recontracting changes, as well as when taxation varies, is examined. The results are then evaluated in light of the data discussed in Section 2.

### 4.2.1 Effects of Flexibility in Contracting

What happens, in this economy, when the probability of recontracting increases? Figure 1 plots GDP per capita, GDP per worker and GDP per hour worked in the benchmark economy.<sup>6</sup> GDP per capita and GDP per worker increase steadily with higher flexibility, the effect being much stronger for the second measure. Conversely, GDP per hour decreases. Flexibility also translates into greater employment, total hours worked, and incidence of part-time, as can be seen in Figure 2. The effect is stronger, however, in terms of total hours than in terms of employment. For all series the effect is very strong at a very low level of flexibility and then weakens as flexibility increases. This is easily explained by looking at the skill composition. In the very rigid economy, only very high productivity pairs are active. Increasing flexibility induces some pairs with slightly lower (but still high) productivity to become active, while low productivity pairs remain inactive. This results in increased employment coupled with

<sup>6</sup>In order to ease comparisons, each series is normalized by the observation at  $\pi = 0.9$ . GDP per capita and GDP per worker are measured on the right scale, GDP per hour on the left scale.

greatly increased production. If one keeps increasing flexibility, newly active pairs are less and less productive, thus while employment keeps raising steadily, production increases by much less. Low productivity pairs tend to favor part-time arrangements. This means that most newly active pairs are part-time, and the proportion of part-time increases as flexibility increases.

Figure 1: Measures of GDP's and recontracting probabilities

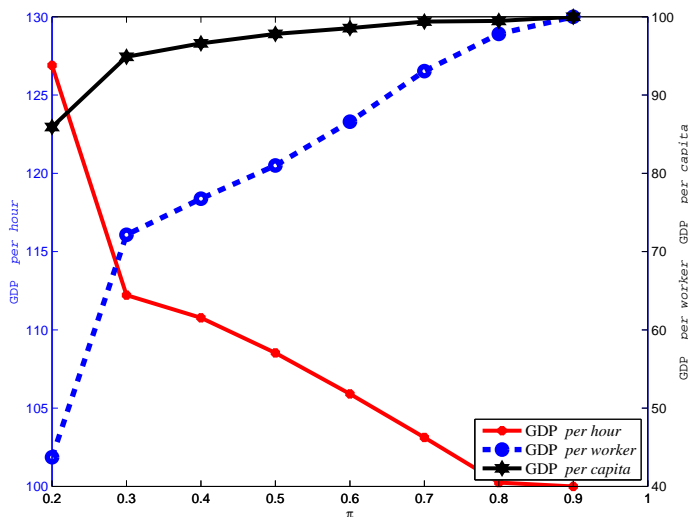
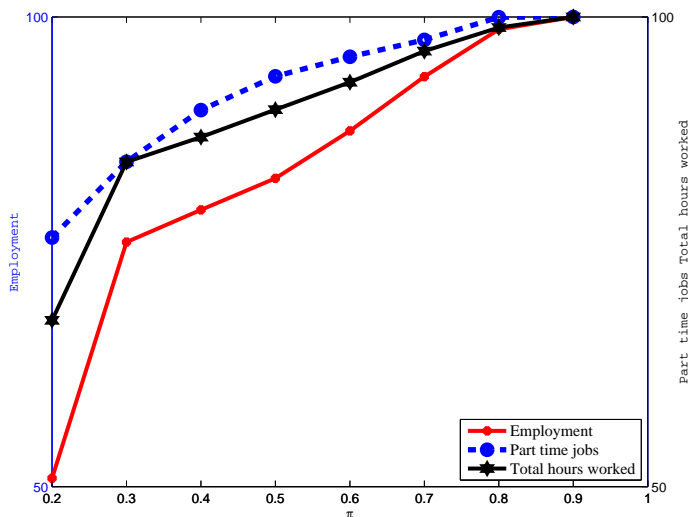


Figure 2: Employment, part-time jobs and recontracting probabilities

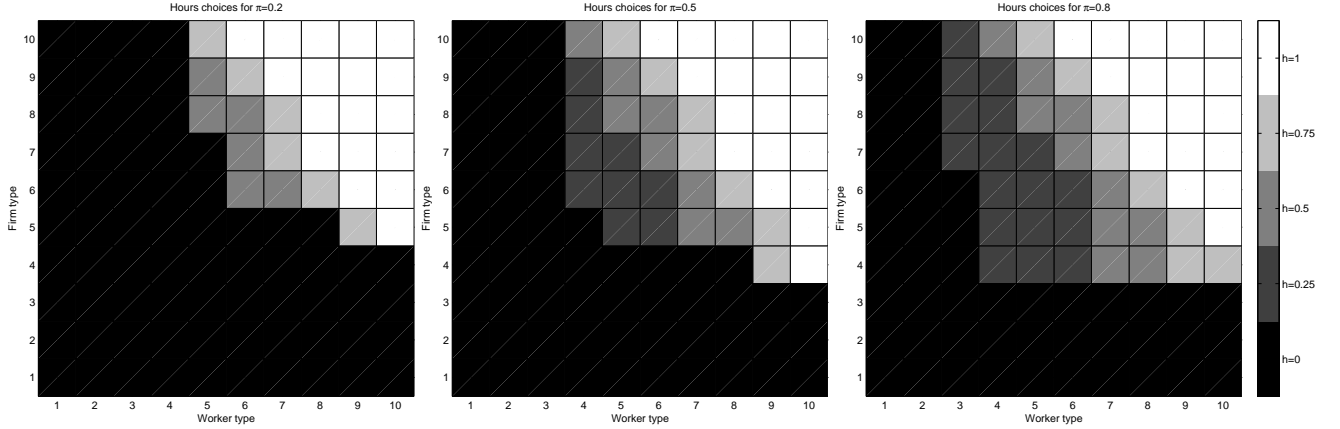


Which pairs are affected by a change in recontracting probability? The answer can be obtained by comparing the matching sets found in Figure 3. In these graphs, the hour choices



made by worker and firm types for three different values of  $\pi$  – 0.2, 0.5 and 0.8 – are depicted.<sup>7</sup> Firms are represented on the y-axis with firm type increasing from bottom to top. Workers are on the x-axis and increase in type from left to right. A black square represents a situation where the corresponding pair does not match. As the color lightens, the percentage of daily time devoted to work increases.<sup>8</sup> For instance, if  $\pi = 0.2$ , a worker of type 6 and a firm of type 7 decide to use 0.5 of a full day for production. Generally, what can be seen is that increased flexibility leads to an increase in the gray zone by moving non active pairs towards part-time contracts. Part-time in our model is thus used as a mean of entering the active pool for non active pairs with lower productivity types. In very few cases, increased flexibility can lead to a pair decreasing its activity. This is the case, for instance, for a type 4 firm and a type 10 worker: when  $\pi$  increases from 0.5 to 0.8, they move from full time to a 75% work day. For these types, when flexibility is lower and part-time is costly, it is better to err on the side of longer rather than shorter day. But as soon there is high flexibility, they can move to their jointly preferred situation.

Figure 3: Hour choices



To grasp what is happening it is interesting to start by thinking of a fully-flexible economy without the possibility of part-time. In an economy with flexible wages and only full-time jobs available, a number of pairs whose period surplus is negative decide to match anyway. If such a pair's joint evolution makes it likely enough to get better in the next period, and if this evolution is more likely than meeting a better partner in the future, the pair decides

<sup>7</sup>It is important to remember that the measure of each pair in these figures differ.

<sup>8</sup> $h$  goes from 0.25 of the available time to 1.0 via 0.5 and 0.75.

to lock up a match. The possibility of part-time evidently eases this: they can now arrange to lock their relationship but with a short day, and can always increase the length of the day (and adjust the wage) if things turn out well. Thus, the effect of introducing the possibility of part-time work in the fully flexible economy is to increase employment. The pairs that choose part-time agreements, however, are not the most productive ones. Hence while employment and production increase, production per hour decreases. Once rigidities are introduced, and hours cannot be recontracted for sure in the future, locking a match with a part-time contract is now risky and not as profitable. This will deter some pairs from locking-up a partnership, which results in lower employment and a lower incidence of part-time jobs. The pairs who renounce part-time agreements are the lower productivity ones, hence while the number of hours decreases the production decreases by less and GDP per hour increases with the increase in rigidity. Summing up, as flexibility increases, more and more pairs close to the margin between work or not will go for part-time work, while some (but very few) pairs who choose part-time when there are high rigidities decide to work full time. Hence employment and the proportion of part-time work increase, with the result that GDP per capita and total hours worked increase. However, a large fraction of the additional hours come from lower productivity matches, thus GDP per hour decreases. Part-time in this model is used as a way to keep specific workers employed, a characteristic present in Dutch part-time (see Hu and Tijdens (2003)).

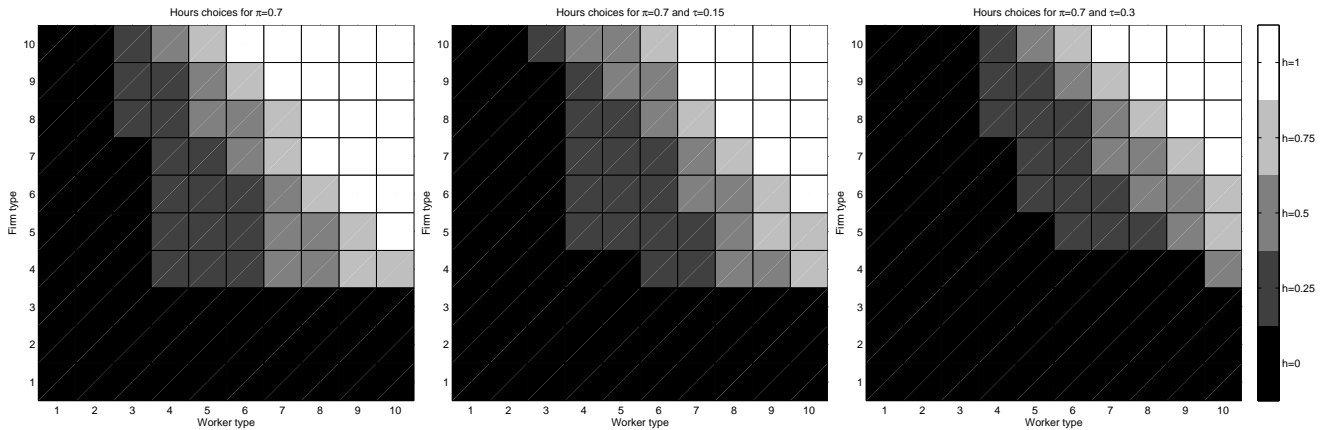
#### **4.2.2 Effect of Labor Income Taxation**

As documented in Section 2, labor income taxation varies across countries. In general, the level of income taxation is much lower in the US than in Europe. It is possible to explain the effects of increased taxation on economies with high or low rigidity in our model. Income taxation distorts the marginal revenue of an extra hour of work. Hence, when the tax rate increases, workers wish to work less for a given wage. With full flexibility, taxation pushes some full-time pairings to work part-time, and some part-timers to become unemployed. The effect of taxation on employment and total hours is clearly negative. The effect on the proportion of part-time jobs is ambiguous, however. All this is confirmed by taking a look at Figure 4, which depicts these effects in the context of pairwise hour choices. Clearly, as taxation increases the white (full-time) area decreases as some of the pairs that work full-time with lower taxation rates move to part-time agreements. Meanwhile, the black (non

employment) area increases, as some of the pairs that choose part-time agreements for lower taxation rates now do not match. In addition, many part-time agreements move to shorter work days. Thus the gray (part-time) area increases in the north-east zone and decreases in the south-west, the total effect on part-time being ambiguous.

What are the effects of higher tax rates on economic performance in the model? The graphs in Figure 5 show all our indicators of economic performance as a function of flexibility for different rates of taxation. Each series is normalized by the value it takes when flexibility  $\pi = 0.9$  and zero taxation. Taxation has a negative effect on GDP per capita and GDP per worker, employment, and total hours. It has a positive effect on GDP per hour. More strikingly, while it has only a small positive effect on part-time at first, the effect increases as the tax rate gets much bigger. The graphs in Figure 6 help us analyze how the effect of flexibility is affected by different taxation rates. Each series is normalized by the value it takes when flexibility is high at  $\pi = 0.9$ . What can be seen in these graphs is that flexibility does not have the same impact on economic performance at different tax rates. For production series, they are stronger the higher the tax rate (GDP per capita and GDP per hour). For employment and the proportion of part-time, the effects are stronger, the lower the tax rate. The effects of flexibility are similar across tax rates for GDP per worker.

Figure 4: Hour choices



#### 4.2.3 Can the Model Explain Cross-country Differences?

We have documented earlier differences across a set of countries in terms of economic performance. As a reminder, the US have higher GDP per capita and lower GDP per hour than

Figure 5: Indicators of economic performance, observation  $(\pi = 0.9, \tau = 0) = 100$

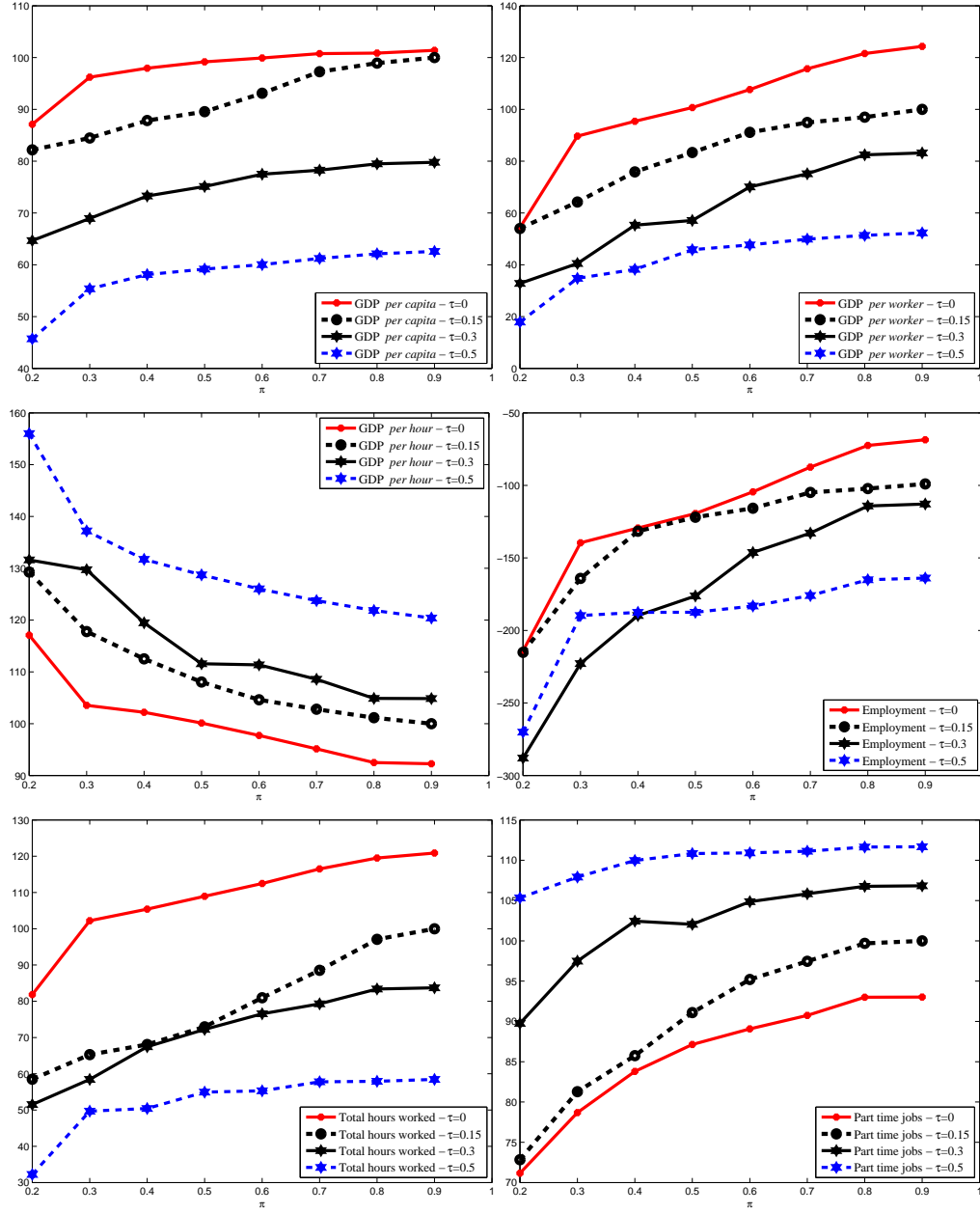
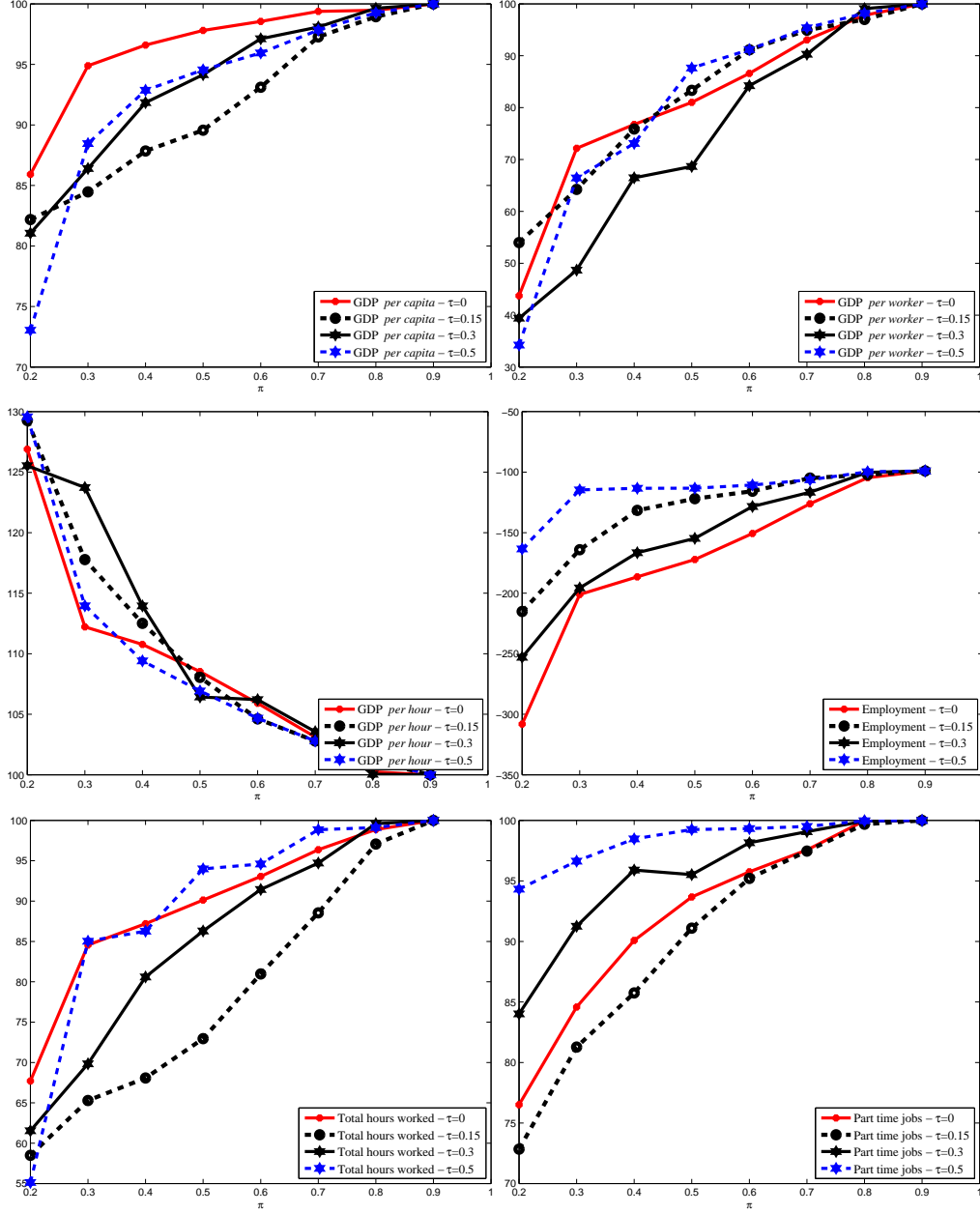


Figure 6: Indicators of economic performance, observations ( $\pi = 0.9$ ) = 100



both France and the Netherlands. At the same time, the US and the Netherlands have employment rates that are similar and greater than the one in France. Finally, the Netherlands has a higher incidence of part-time jobs relative to France and the US. Can flexibility account for these differences? Assume that flexibility is high in the US ( $\pi = 0.8$ ), so that contracts are changed on average every 3 months and a half, that it is slightly less in the Netherlands ( $\pi = 0.7$ , or an average contract duration of 4 months and a half) and lower still in France ( $\pi = 0.4$ , average contract duration of 7 months and a half). In this case our model delivers similar economic performance in the US and the Netherlands, with higher GDP per capita, employment, and part-time incidence, and lower GDP per hour, than is the case in France. This is counterfactual. On the other hand, focusing on the impact of differentials in labor income taxes (as Prescott (2003) and Ohanian, Raffo, and Rogerson (2006) do) yields the following situation. Countries with higher tax rates exhibit lower employment, lower GDP per capita, higher GDP per hour, and a greater proportion of part-time jobs. This implies that France and the Netherlands should have similar economic performances, and that both the Netherlands and France should have more part-time jobs compared to the US. This is clearly counterfactual, too. Table 4 shows what happens when differences in labor income taxation and differences in flexibility are present simultaneously. All series are normalized in terms of the parametrization that represents, in our view, the US ( $\pi = 0.8, \tau = 0.15$ ). If one assumes that the taxation rate in France and the Netherlands is twice that of the US, and one maintains the same assumption than above concerning flexibility, simulations and observations are reconciled, perfectly from a qualitative view point and nicely from a quantitative one. Our model can replicate well quantitatively the differences in GDP per capita and employment between these countries. The model, however, overestimates GDP per capita for a rigid country like France and underestimates the difference in part-time between the Netherlands and the other countries. The first of these slight discrepancies is due to the amount of sorting in the model. High rigidity leads to the complete disappearance of low-skilled activities in the model. While low-skilled (so called proximity) jobs seem to have disappeared to some extent in France, the model obviously exaggerates this effect. As can be seen from Table 4, small variation of rigidity will not affect the result drastically.

In the next section, robustness to change in parameters is discussed.

Table 4: Results for a set of taxation rates and flexibility

pi	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Tau = 0.0							
GDPpc	97.25	99	100.24	101	101.86	101.95	102.49
GDPpwk	92.47	98.37	103.82	110.99	119.27	125.35	128.17
GDPphw	102.36	101.04	99	96.61	94.07	91.44	91.22
Tothours	105.3	108.6	112.23	115.88	120.01	123.12	124.53
N	136.16	126.33	116.67	102.18	85.63	71.16	67.38
E	85.78	89.65	93.45	99.14	105.65	111.34	112.83
proppart	78.93	84.06	87.41	89.35	91.03	93.29	93.31
Tau = 0.15							
GDPpc	85.38	88.79	90.52	94.11	98.32	100	101.08
GDPpwk	66.23	78.23	85.92	93.97	97.87	100	103.1
GDPphw	116.44	111.24	106.82	103.43	101.63	100	98.87
Tothours	67.26	70.13	75.15	83.42	91.22	100	103.02
N	159.96	128.46	119.09	113.11	102.58	100	96.88
E	76.43	88.81	92.49	94.85	98.99	100	101.23
proppart	81.53	86.02	91.38	95.51	97.77	100	100.32
Tau = 0.3							
GDPpc	69.68	74.07	75.93	78.32	79.11	80.35	80.65
GDPpwk	41.75	57.02	58.9	72.25	77.45	84.99	85.78
GDPphw	128.24	118.11	110.31	110.09	107.34	103.69	103.65
Tothours	60.22	69.51	74.42	78.86	81.68	85.89	86.24
N	216.84	184.78	171.71	142.68	129.69	111.61	110.27
E	54.06	66.67	71.81	83.22	88.33	95.44	95.96
proppart	97.79	102.77	102.37	105.19	106.17	107.1	107.17

#### 4.2.4 Robustness

There are a number of parameters to examine, among them risk aversion ( $\sigma$ ), marginal return to hours ( $\mu$ ), relative importance of labor productivity in production ( $\alpha$ ). But first, we look at how our results are affected by a simple unemployment insurance scheme giving out a transfer to unemployed workers, independently of their unemployment and wage history.

##### *Unemployment Insurance*

The effect of the introduction of a small transfer to the unemployed in a flexible economy is to reduce employment starting with the pairs with the smallest working days (quarter-time) and, as the transfer size increases, hitting pairs with longer work days. The result on the indicators of economic performance is to reduce employment, part-time work, total hours, GDP per capita and to increase GDP per hour. Introducing such a simple unemployment scheme would help our model replicate better the observed differences in the proportion of part-time jobs, but would further increase the GDP per hour of the most rigid country. A more sophisticated way of modeling unemployment insurance, with payments depending on past wages, could help on this front (but would be very hard to introduce numerically).

##### *Risk aversion*

Increasing the workers risk aversion leads them to accept more easily to match. This results in an economy with less non-employment but a high level of mismatch. Both GDP per capita and GDP per hour are reduced slightly. The proportion of part-time increases at first and then stabilizes.

##### *Marginal product of hours*

Decreasing the marginal product of hours,  $\mu$ , has a positive effect on part-time work when flexibility is high. The effect gets smaller as flexibility decreases. Overall, the increase in part-time results in a decrease in GDP per capita and hours worked and an increase in GDP per hour. For very high level of flexibility, it is even possible to observe a small increase in employment subsequent to the decrease in  $\mu$ .

##### *Relative importance of labor productivity in production*

Varying  $\alpha$  has a negligible effect on the indicators of economic performance, but changes the way the matching sets look like. More weight on the firms leads to a slightly higher GDP per capita and GDP per hour, to an increase in employment and in hours worked, and in a decrease in the proportion of part-time jobs.



### *Disutility of labor*

A decrease in the parameter  $a$ , by decreasing the importance of leisure for workers, leads to higher employment, higher GDP per capita, lower GDP per hour and a lower incidence of part-time. The effect of variations in flexibility is dampened.

### *Marginal disutility of labor*

Lower marginal disutility of labor increases employment and GDP per capita, and lower GDP per hour and the incidence of part-time.

Are both rigidities necessary for the results to arise in the model? To answer this question, the effects due to increased flexibility in wages from those due to increased flexibility in hours worked are separated.

### *Rigid hours, flexible wage*

It is assumed first that wage recontracting is possible in every period, but that hours can be adjusted only with probability  $\pi$ . In the economy with flexible wages but rigid hour choices, GDP per capita and per worker increase with the probability of recontracting. It is worth noting that GDP per hour also increases with  $\pi$ . These two features are explained by the behavior of employment and of the proportion of part-time jobs. Employment increases as the flexibility in adapting hours increases, but less and less. The proportion of part-time jobs increases at first, then decreases slightly. The result is that total hours worked is increasing in  $\pi$ , but by less than the increase in GDP per capita, which explains why GDP per hour is increasing in  $\pi$ .

Taxation has the same effect as in the economy with full rigidity. GDP per capita is decreasing with  $\tau$  while GDP per hour is increasing. Employment decreases when taxes are increased, and the proportion of part-time jobs increases. In terms of relative magnitude in the change in employment, taxes have the highest effect in economies with low flexibility. A small increase in taxation (starting from  $\tau = 0$ ) have greater effects in flexible economies, while a great increase impacts the high rigidity economies a lot. This is especially the case for the proportion of part-time jobs.

### *Rigid wage, flexible hours*

When it is assumed that hours can be rebargained in every period, but that wage cannot necessarily be adjusted, the results are qualitatively similar to the situation in which both hours and wages are set in staggered fashion. GDP per capita and GDP per worker

increase with flexibility, although the rate of increase is decreasing. GDP per hour is almost unchanged when  $\pi$  varies. Employment and the share of part-time jobs are increasing in  $\pi$ , but decreasingly so. The effect of taxation is similar here than it is in the benchmark case, except for the behavior of the share of part-time jobs. Part-time jobs increase in the most rigid economy even with a small increase in taxation in this economy, while it varies very little and even decreases when  $\tau$  increases from 0 to 0.3 in the benchmark case.

Contrasting the results of the case in which only wages are rigid to those of the case where only hours are rigid is instructive. Note first that the rigidity in wages has very small effects on the various measures of GDP. The rigidity in hours has larger effects on these measures. The effects are similar in both partial-rigidity cases in terms of employment. Looking at the effects of partial rigidities on the share of part-time jobs, note that, when hours are flexible, the share increases at a decreasing rate as rigidities decrease. When wages are flexible, it increases at first and then starts decreasing. Finally, the effects of an increase in taxation are qualitatively similar in both cases, but the magnitude is smaller in the case where wages are flexible.

The interaction between the two types of rigidities is therefore necessary for the benchmark model to deliver our results.

## 5 Conclusion

Institutions explain performance. This paper shows that differences in labor market institutions and labor income taxation explain a constellation of measures of economic performance across countries. Our model economy is a two-sided matching model with ex-ante agent heterogeneity and idiosyncratic shocks in which labor/leisure choices, bargaining over the length of the workday and bargaining frictions are introduced. In such a model, a country with greater rigidity in wage setting and hour choices is stuck at a lower level of GDP per capita, lower level of employment and higher level of GDP per hour than a country with more flexibility. This arises because worker-firm pairs who would work part-time, were they given the possibility of changing the contract in the near future, are deterred from doing so by the rigidity. Hence, the proportion of part-time jobs is smaller in the economy with greater rigidity. On the other hand, the introduction of labor income taxes results in a smaller level of GDP per capita, a higher level of GDP per hour, a lower level of employment and a higher

proportion of part-time jobs. The model, therefore, explains differences between the US, France, and the Netherlands.

More precisely, given that France is a country with higher wage and hour rigidities and high taxation, that the Netherlands is a country with less rigidity and high taxation, and the US has the lowest level of rigidity and the lowest level of income taxation, the model predicts that France has a low employment level, a low fraction of part-time jobs, a low GDP per capita and a high GDP per hour. It predicts that the Netherlands has a high employment level, an important fraction of part-time jobs, a low GDP per capita and a high GDP per hour, and it predicts that the US has a high employment level, a lower share of part-time jobs, a high level of GDP per capita and a low level of GDP per hour. All these features are clearly in the data. We also show that a plausible calibration of our model permits accounting quantitatively for the main differences in performance observed between the US, French and Dutch economies.

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# Appendices

## A More on Economic Performance and Labor Market Institutions: Levels and Trends

In this appendix, more details about economic performance and labor market institutions for the US, the Netherlands, and France are provided.

### A.1 Economic Performance

GDP per capita, GDP per hour, employment and labor force participation for the period 1970 to 2005 for the US, France and the Netherlands are displayed in Figure 7. Total hours, hours per capita and hours per worker can be found in Figure 8.<sup>9</sup> The US had a higher GDP per capita over all the period, and the gap has even increased of late. The employment rate was higher in France and the Netherlands than in the US in 1970, but dipped in these countries during the seventies, while remaining constant in the US. In the eighties, while

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<sup>9</sup>All data used here is from the OECD statistical database (Employment rate and Labor force participation rate) or the treatment of this data by the Groeningen Growth and Development Center (Hours and GDP per hour).

France's employment rate remained constantly low, the Netherlands' employment rate went on an upward trend and got back to the level of the employment rate in the US.<sup>10</sup> Looking at Labor force participation, one notices that all three countries exhibit an upward trend in the labor force participation rate in the seventies, but this trend grows stronger in the Netherlands after 1987 while it becomes very weak for France in the eighties. Looking at Figure 8, the US had more total hours than both France and the Netherlands in 1970, and while hours went on a downward trend in both European countries, they remained relatively constant in the US. Controlling for the population, one notices that hours per capita increased in the US while it decreased in France. In the Netherlands, hours per capita followed the French trend until the early 1980's but then started increasing again until recently. Controlling for workers, the situation is relatively stationary in the US and decreasing in both France and the Netherlands. The evolution of employment and hours over the period at hand results in an increase in GDP per hour in France and the Netherlands relative to the US. In the most recent years, however, the Netherlands has seen a reduction in its level of GDP per hour relative to the US.

The change in trends in the early 1980's in the Netherlands can be attributed to increased flexibility in the labor market, and most notably an increased flexibility regarding part-time work in the Netherlands.<sup>11</sup> Data on part-time jobs as a proportion of all jobs in 2002 can be read in Table 5. In addition to the numbers for the whole population, data for three categories of age is given. The Netherlands have the highest proportion of part-time jobs in the whole population (33.9%).<sup>12</sup> In the other countries, part-time employment is less prevalent. The use of part-time work is highest in the 15-24 age category, not a surprise since most working individuals in that age category will do so in parallel to pursuing a diploma. Partial work days are less present in the age category 25-54, even more so when focusing on males of age 25-54. But even in the latter category differences across countries are still striking. Finally, the proportion of part-time jobs is greater again in the population of age 55 and more.<sup>13</sup>

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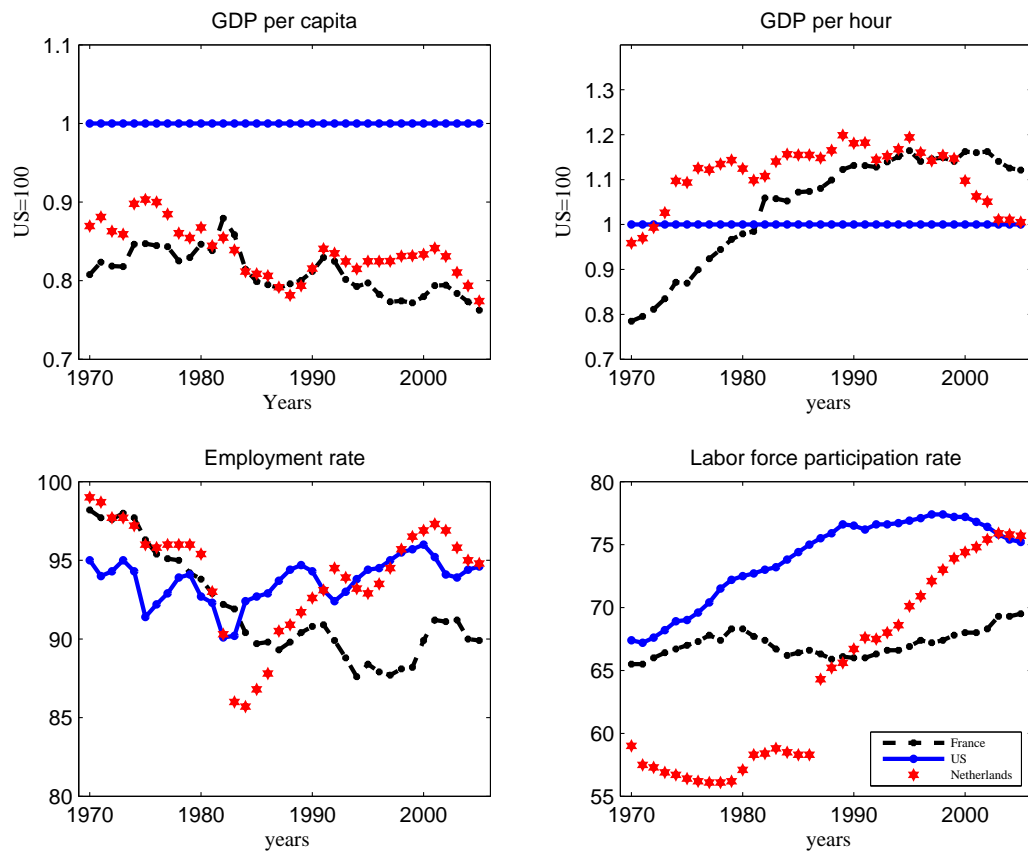
<sup>10</sup>The discreet jump in the employment rate and the labor force participation rate in the Netherlands in 1987 is due to a change of series.

<sup>11</sup>Part-time jobs are defined by the OECD as jobs for which the individuals work less than 30 hours a week.

<sup>12</sup>To a large extent, part-time work is chosen in accordance with the preferences of workers. For instance, 78 % of working part-time women in the Netherlands do not want to work full-time (see Nickell and van Ours (2000)). In addition, there is evidence that a large fraction of part-time in the Netherlands is of the retention type (See Hu and Tjstens (2003)).

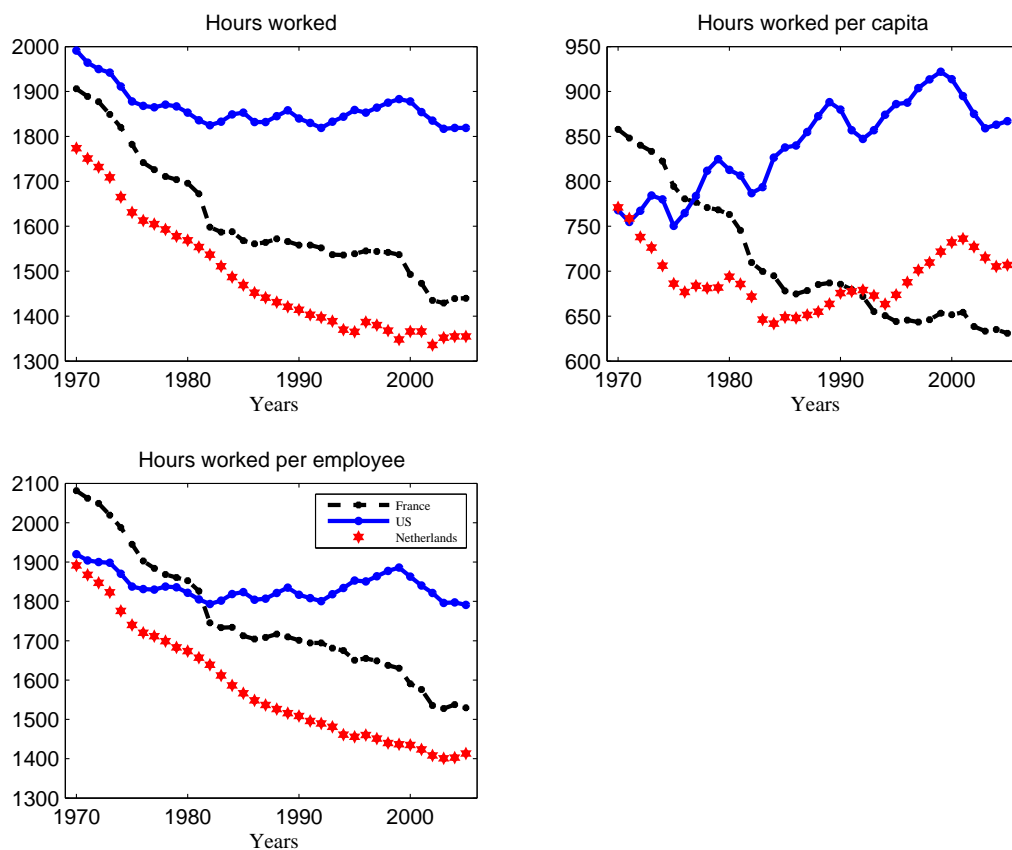
<sup>13</sup>In France and in the Netherlands, women of age 55 and more account for most of women part-time, with women in the 15-24 age category coming a close second.

Figure 7: Economic Performance



Source: OECD Statistical database and Groeningen Growth and Development Center.

Figure 8: Hours worked per worker and per capita



Notes: Hours per capita = Total Annual Hours Worked (in thousands) / Midyear population (in thousands of persons),  
Hours per employee = Total Annual Hours Worked (in thousands)/Persons engaged (in thousands of persons)  
Source: Groeningen Growth and Development Center.



Looking now across gender, one observes that the proportion of women employed part-time is higher than the proportion of men.

Table 5: Part-Time Jobs – Percent of all Jobs

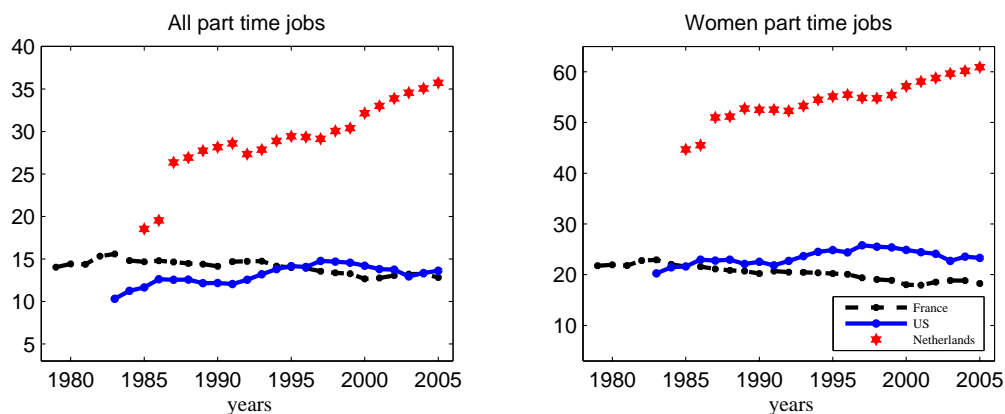
Country	All			Age 15-24			Age 25-54			Age > 54		
	Men	Women	Share	Men	Women	Share	Men	Women	Share	Men	Women	Share
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(10)	(11)	(12)	(13)	(14)
France	5.2	24.1	79.5	9.7	26.6	67.6	4.1	23	82.7	10.6	32.3	71
Netherlands	14.7	58.8	75.4	49.3	60.7	53.5	5.9	57.1	88.3	26.8	71	56.8
US	8.3	18.8	68.2	29.1	40	56.9	2.7	13.2	81.9	13	22.5	62.9

Notes: Data for 2002. Columns labeled ‘Share’ contain the share of women of total part-time work. Other columns contain the proportion of part-time work.

Source: OECD Statistical database.

The evolution of the proportion of part-time jobs over time is also instructive, as can be witnessed in Figure 9. Over the last twenty years the Netherlands always had the greatest proportion of part-time work in the whole population. This is mostly explained by the fact that part-time work is very prevalent for women in that country.<sup>14</sup> The importance of part-time work among women is true for other countries as well. Finally, except in the Netherlands, there is little change in part-time employment for the 25 – 54 age group within the whole population. In the Netherlands, the proportion of part-time jobs has increased a lot in that category (as in all categories).

Figure 9: Part-time jobs – whole population



<sup>14</sup>See Pissarides, Garibaldi, Olivetti, Petrongolo, and Wasmer (2005) for more on this topic.

Table 6: Labor market institutions

	France	Netherlands	United States
Union Density	9.7	23.2	12.8 <sup>a</sup>
Wage Bargaining	<b>95</b>	80	<b>14</b>
Centralization	2	3	1
Coordination	2	<b>4</b>	1
Bargaining frequency (years)	1.5	<b>0.5</b>	No pattern
Weekly normal hour limits	<b>35–39</b> <sup>b</sup>	40 <sup>c</sup>	40 <sup>d</sup>
Maximum legal weekly hours <sup>e</sup>	41–47	41–47	<b>No limit</b>

Notes: Trade Union density: data from administrative sources except where stated. Data for 2000. Wage bargaining: percentage of employees covered by collective agreements as a percentage of the total number of employees. Data for 2000. Centralization and coordination: index from 1 (least centralization and coordination) to 5 (highest level of centralization and coordination). Data for 2000.

Source: OECD Statistical database (wage bargaining and union density), OECD Employment Outlook 2004 (centralization and coordination), Délégation du Sénat pour l'Union Européenne (1998) (bargaining frequencies), and McCann (2005) (restrictions on hours worked).

<sup>a</sup> Survey. <sup>b</sup> Labour Code, Decree No. 2002-1257, 2001. <sup>c</sup> Working Time Decree, 1995. <sup>d</sup> Fair Labor Standards Act, 1938. <sup>e</sup> Includes extra time.

## A.2 Labor Market Institutions and Income Taxation

Countries differ greatly in terms of legislation on unions, wage setting, hours worked, and taxation. Some of these facts are reviewed. In particular, given that the model described below makes use of (i) varying average time between recontracting possibilities, (ii) choice of hours, (iii) taxation differences, and that, in addition, it is closely linked to other labor market institutions, the situation in the countries of interest is reviewed. It is argued that the US is the country with the most flexible labor market characteristics and the lowest level of income taxation and that France is the opposite extreme. It is also shown that the Netherlands have level of income taxation similar to that in France but have implemented changes in the labor market legislation which have greatly increased the flexibility of their labor market.

## A.3 Labor Market Settings

Table 6 displays data on union density, wage bargaining through collective agreements, indexes of centralization and coordination between unions, employers, and governments, frequencies of bargaining, and restrictions on hours worked for the same set of countries.

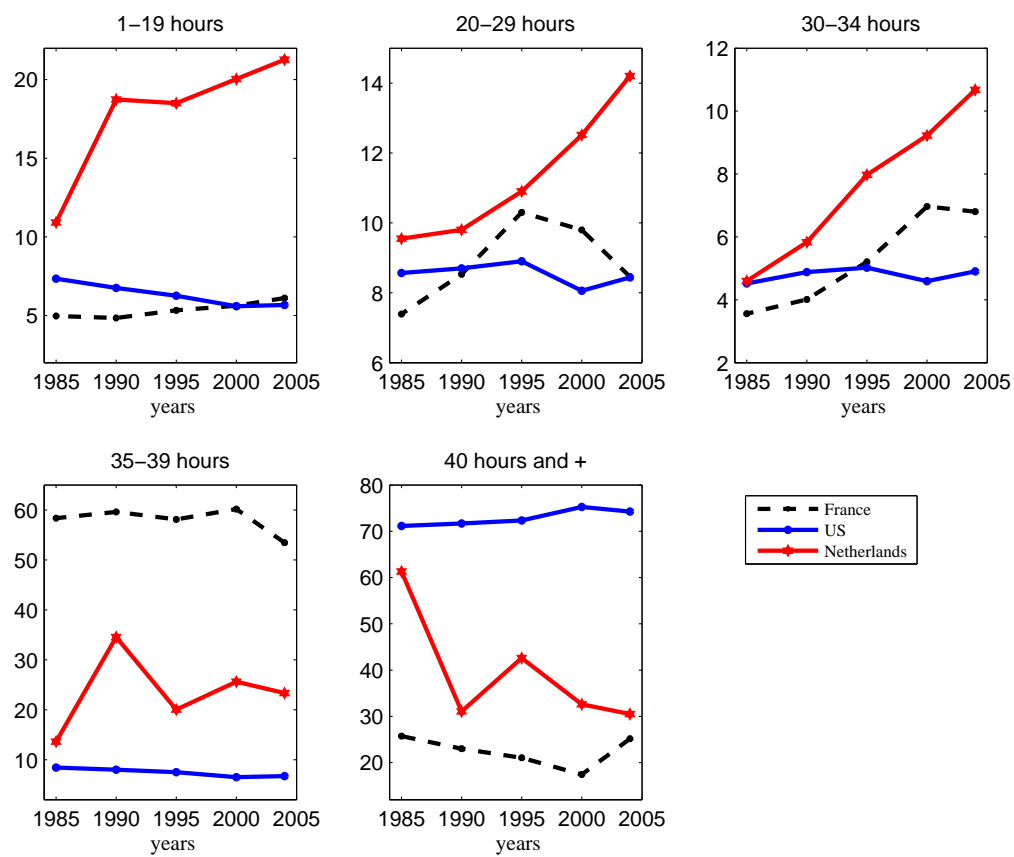
The US is a country characterized by the highest level of flexibility on the labor market.

It has the lowest level of wage bargaining (collective bargaining coverage of 14%) among the three countries. Bargaining takes place exclusively at the firm level and with no particular pattern in terms of bargaining frequency. The situation is also very flexible regarding choices of hours worked. The normal work week in the US is similar to the one in the other two countries but there is no legal maximum number of weekly hours. In addition, evidence from weekly hour bands indicates that most people work full time in the US, and Americans tend to work long weeks (see Figure 10).

France and the Netherlands have a collective bargaining coverage greater than 80%. This is true even though union density is relatively small (less than 20% in France and between 20% and 30% in the Netherlands). Wages are defined at the national level at first, then renegotiated at the sector level, in the Netherlands. Wage negotiation takes place within firms in France, but is sometimes framed by sectoral agreements. According to a research document from the French Senate, (*Délégation du Sénat pour l'Union Européenne* (1998)), negotiations take place every year and a half in France and twice a year in the Netherlands while it can take place anytime in the US. The legal maximum number of weekly hours, which includes extra-time, is limited in both France and in the Netherlands. Data on weekly hour bands underline the fact that most people work full time in France, as is the case in the US, that Americans tend to work longer weeks, and that the population is spread out over most hour bands in the Netherlands (see Figure 10).

Apart from the frequency of negotiations, what distinguishes the Netherlands from France is the high level of centralization and of coordination between unions, employers and the government. This leads the Netherlands to have a higher degree of flexibility of the labor market. In that country, since the early 1980's, there have been important discussions between the government, the unions, and the employers which have led to a great level of coordination between all social partners. In 1982, the Wassenaar agreement marked a change in relations between Dutch unions, employers and the government. Unions agreed to more flexibility in wage setting and hours worked, and to give up resistance to part-time work. (See Nickell and van Ours (2000) for more details.) The Wassenaar agreement, as well as others that followed, have lead the unions to repeatedly accept greater flexibility in terms of choices of the working day, and to remove obstacles to part-time work. This process of improvement of flexibility is still taking place. For instance, the part-time Employment Act, passed by

Figure 10: Weekly hours band 1985–2004 (%)



Source: OECD Statistical database.

the lower house of the Dutch Parliament in February 2000, awards employees the right to increase or reduce their working hours. This is backed up by the survey “Doing Business 2006” of the OECD which presents an index of rigidity in OECD countries.<sup>15</sup> While the US is categorized as a completely flexible labor market (the rigidity index is 0 for all categories), France counts among the most rigid labor markets, and the Netherlands, while not exempt from rigidities, are much more flexible than France. Taking a look at the index of rigidity in hours and in employment, for instance, the US score 0 in both while France scores 60 and 56 out of a maximum of 100, and the Netherlands score 40 and 42.

### **A.3.1 Labor Income Taxes**

Labor income taxation is likely to influence labor/leisure decisions of households. Prescott (2003) discusses the effects of effective marginal tax rates on labor income in Germany, France, Italy, and the US. He shows that differences in tax rates account for most of the differences in labor supply in these countries (except Italy).

Effective income taxation levels are presented in Table 7. This table clearly shows that the labor income tax is much higher in France and in the Netherlands than in the US. Income taxes increase over time in all countries, and to a larger extent in the Netherlands and in France.

### **A.3.2 Labor market setting, a summary**

To summarize, the US is characterized by a high level of decentralization, a low level of coordination between social partners and a relatively low level of coverage. Within Europe, one can distinguish France from the Netherlands. In France, negotiations are decentralized and not frequent, union density is low and coordination between social partners is weak, but collective bargaining coverage is high. The Netherlands are characterized by a higher degree of centralization, more coordination and a high collective bargaining coverage with more frequent negotiations. The combination of these three elements greatly improves the flexibility of the Dutch labor market. In addition, the US has a low effective tax rate compared to the two European countries. Hence the US can be seen as a low income tax, highly flexible

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<sup>15</sup>The methodology used in “Doing Business 2006” was originally developed by Botero, Djankov, LaPorta, and Lopez-De-Silanes (2004).

country compared to France which is characterized by both high labor market rigidities and high income taxation, and the Netherlands stands in the middle as an economy with a relatively flexible labor market but a high level of income taxation.

Table 7: Effective Tax Rates on Labor Income, 1965–1997

Countries	1965–1970	1971–1975	1976–1980	1981–1985	1986–1990	1991–1997
France	33.9	33.0	37.9	42.6	45.9	47.2
Netherlands	36.1	42.7	47.1	48.5	49.3	50.5
US	20.1	23.0	25.1	25.3	25.9	26.7

Notes: Mendoza–Razin–Tesar effective tax rates updates through 1997 calculated using the method proposed in Mendoza, Razin, and Tesar (1994).